are historical details not easily attainable elsewhere. There is a valuable annotated list of minerals and an excellent bibliography. There is some need for the author to take greater care to attain a form of expression which may be grasped by those not necessarily widely read in the science. Unusual words such as femic, salic, crenitic and the like might best be omitted. In the stratigraphical table, page 5, if Carboniferous is replaced by Carbonic, why not use also Cambric, Siluric, Devonic and Cretacic. In the treatment of the stratigraphy of Manhattan Island, it is far simpler and clearer to take up the Fordham gneiss, the Inwood limestone and the Manhattan schist, than to treat merely of gneiss, limestone and schist, with minor varieties. If, when a fourth edition is called for, the author will place himself in the attitude of a reader not of profound attainments in geology and, thus grasping his or her point of view, will put the facts of the local strata in simple and clear language, and will add an index, a work already serviceable and of value will be made still more so.

J. F. Kemp

*An Elementary Treatment of the Theory of Spinning Tops and Gyroscopic Motion.* By Harold Crabtree. Pp. xii + 140. New York, Longmans, Green & Co. 1909.

This is a very satisfactory book for one who wishes to gain a clear understanding of gyroscopic action. It contains a good discussion of Schlick's method of steadying vessels at sea and of Brennan's gyroscopic mechanism for balancing a monorail car.

The introductory chapter describes a number of curious and interesting forms of tops and gyroscopes. Chapter I. discusses rotation about a fixed axis, Chapter II. discusses precession and Chapter III. is a discussion of the phenomena described in the introductory chapter.

The starting of precession and gyroscope oscillations are discussed in Chapter IV., and the remainder of the book, Chapters V., VI., VII., VIII. and IX., discuss the more elaborate aspects of the theory of gyroscopic action.

The curious behavior of the stone implement known as the celt which is described on pages 7 and 54 may be observed with an ordinary pocket-knife with a rounded back. When such a knife is twirled on a smooth table the reaction of the table due to its vibratory motion causes its direction of spin to be reversed and if the knife is set rocking about a horizontal axis the reaction of the table due to the vibratory motion produces a slight spin about a vertical axis.

Altogether the book is a welcome and valuable addition to the literature of rotatory motion.

W. S. Franklin

## SPECIAL ARTICLES

### A SIMPLE CLOUD APPARATUS

The celebrated experiment on the production of clouds by C. T. R. Wilson forms an instructive lecture table demonstration. This need not necessarily be a difficult experiment. It is common observation that clouds of greater or less density are often seen upon the first few strokes of the pump when evacuating a vessel containing some moisture. The apparatus as Wilson constructed it was of necessity rather elaborate. That it may be of exceedingly simple and inexpensive construction and yet capable of giving quantitative results of a fair degree of accuracy is the object of this paper.

The apparatus consists of a glass bulb having two openings. To one, the larger, is attached a stiff rubber bulb, to the other a nipple for the introduction of the gases, etc., to be investigated. For qualitative results the glass vessel is blown in the form of a hooded bulb *B*, as shown in Fig. 1. This bulb should have a volume of about 75 c.c., while the hand bulb *HB* may be the stiff bulb that comes with an hydrometer syringe for testing electrolytes. The volume of this bulb should be about 250 c.c. The nipple *n* is closed by a rubber tube and a screw pinch-cock at *p*. It is well to insert a short glass tube extension beyond *p*. To operate, draw into the bulb *B* two or three cubic centimeters of water. This will be caught by the annulus or trough in *B*, thus keeping the gas in the bulb in contact with

water and hence more or less completely saturated. Close pinch-cock at $p$ firmly. Now by compressing $HB$ moderately and then releasing suddenly a dense cloud, in general, will be formed in $B$.[1] Repeated compressions and expansions will bring down clouds of rapidly diminishing densities. The bulb $B$ will be

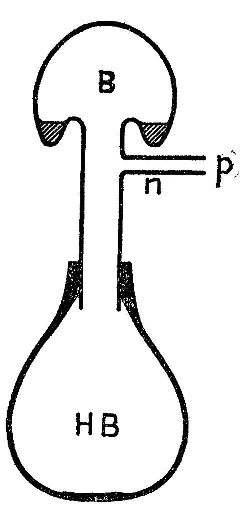


Fig. 1.

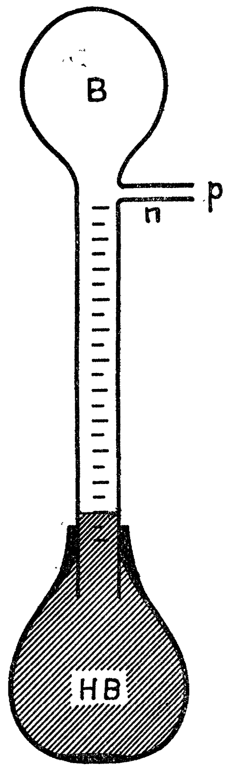


Fig. 2.

freed of dust particles by about the tenth expansion—depending upon the dustiness of the air originally drawn into the apparatus. Having freed the condensing chamber of dust particles, a dense cloud can again be formed by compressing the bulb firmly and then releasing. In this instance the expansion—*i. e.*, the ratio of the final to the initial volume of the gas—is greater than the critical value which for dust-free air is about 1.30.

The apparatus is now ready for the performance of a number of interesting and striking experiments. The formation of a single drop in the expansion chamber is not an uncommon sight. As is well known when the drops are few they are of large size and fall rapidly, while dense clouds formed in dust-laden air, or in dust-free air exposed to an ionizing agent, are composed of small drops, exhibit color effects and often may be quite opaque. This cloud settles slowly. The effect of dust is shown in a marked way by drawing into $B$ a whiff of air laden with chalk dust. An exceedingly opaque cloud is obtained by presenting the nipple $n$ to a burning match and drawing in some of the particles of carbon. It requires some twenty or thirty expansions to free the bulb of these particles. Dense clouds are formed by drawing in the gases through which an electric discharge is passing. The ionized air from the active side of a Roentgen ray bulb gives a marked effect. These cloud effects can be projected readily on a screen.

TABLE I

*Critical Expansion in Dust-free Air*

| Zero | Upper Reading | Ratio | Cloud Effect |
|---|---|---|---|
| 65 | 55 | 1.18 | None. |
| 65 | 54 | 1.20 | None. |
| 65 | 53 | 1.22 | None. |
| 65 | 52 | 1.25 | None. |
| 65 | 51 | 1.27 | None. |
| 65 | 50 | 1.30 | A few dozen drops. |
| 65 | 49 | 1.33 | A dense cloud. |
| 65 | 48 | 1.35 | The same. |
| 65 | 47 | 1.38 | Very dense. |

For quantitative results the apparatus is modified slightly. The trough in $B$ may be omitted. The tube $T$ should be 20 to 25 cm. long and graduated in cubic centimeters as shown in Fig. 2. The hand bulb $HB$ and the tube $T$ are filled with water to some convenient zero on the graduation. To operate, compress $HB$ sufficiently to give the desired ratio on expansion. The free water column acts as an index and its proximity to $B$ insures saturation. It is imperative that the walls of $HB$ be of double or treble strength, otherwise the bulb on release will expand beyond the set zero. For individual observation the bulb $B$

[1] J. J. Thomson's "Conduction of Electricity through Gases," p. 167.

should be placed in front of a dead black screen and illuminated by a shielded lamp. A reading glass will aid considerably in observing the formation of the drops.

First determine the critical ratio, *i. e.*, the expansion at which drops just begin to form in dust-free air. Now produce expansions of gradually increasing amounts and note the cloud effects. A typical series is given in Table I.

As Thomson pointed out, after once drops have been formed in dust-free air they will form for some time after for expansions less than the critical value. Hence before another series is taken the bulb $HB$ should be worked for moderate expansions to free the bulb $B$ of nuclei. In Table II. are recorded two observations taken from each of ten different series similar to that given in Table I. The first observation, the critical expansion, is when drops first appeared, and the second is the next succeeding observation. This is recorded in the table to show how rapidly, yet uniformly, the drops increase by a slight increase in the expansion.

TABLE II

*Critical Expansion in Dust-free Air*

| Tube | Zero | Upper Reading | Ratio | Cloud Effects |
|---|---|---|---|---|
| 1 | 76 | 58<br>57 | 1.31*<br>1.33 | A few large drops.<br>A few hundred. |
| 1 | 75 | 57<br>56.5 | 1.31*<br>1.33 | Quite a cloud—large drops.<br>A dense cloud. |
| 1 | 76 | 58<br>57.5 | 1.31*<br>1.32 | Just a few drops.<br>About 50 drops. |
| 2 | 65 | 50<br>49 | 1.30*<br>1.33 | A few dozen drops.<br>A dense cloud. |
| 1 | 71 | 54<br>53 | 1.31*<br>1.34 | A few dozen drops.<br>A dense cloud. |
| 2 | 65 | 50<br>49.5 | 1.30*<br>1.31 | A few dozen.<br>A dense cloud. |
| 1 | 77 | 58.5<br>58 | 1.32*<br>1.33 | A few drops.<br>A few hundred. |
| 1 | 77 | 58<br>57.5 | 1.33*<br>1.34 | A few dozen.<br>A few hundred. |
| 1 | 77 | 58.5<br>58 | 1.32*<br>1.33 | A few drops.<br>A few hundred. |
| 1 | 77 | 58.5<br>58 | 1.32*<br>1.33 | A few drops.<br>A few hundred. |

Average of those marked (*) 1.31.

The average value of the critical ratio is 1.31. It should be noticed that the greatest variation from this mean is only 1.5 per cent.—a rather close agreement when we consider that the observations were made with two different tubes, and also that they extended over three or four weeks.

It was shown by Wilson that an ionizing agent is an important factor in the formation of drops in dust-free air. Various agencies, such as light from an incandescent lamp filament, the radiation from radium, the Roentgen rays, etc., were tried, each showing a decided effect. On placing a small glass capsule containing 10 milligrams of radium bromide of 200,000 activity within the bulb $B$ a mean value of 1.27 was obtained for the expansion necessary to form drops. Care was taken to free the expansion chamber of dust particles, also to correct for the change in volume caused by the introduction of the small glass tube containing the radium. Again, with this simple apparatus it is not difficult to compare quantitatively the electrification when air is agitated with pure water, with a saturated common salt solution, and with mercury. The effects were all quite marked and the values obtained for the expansions could be repeated consistently at will.

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## SYSTEM OF BASKETRY TECHNIC

ONLY in recent years have anthropologists interested themselves so generally in the industrial arts of primitive peoples. With this awakening interest has come the appreciation of the prominent place occupied by the cruder forms of weaving—namely, basketry—in the domestic economy of these simple households. It has assisted in the sheltering, the clothing and the feeding of tribes in many parts of the world. This wide distribution of locality, as well as that of usefulness, enables one to better understand the multiplicity of technics which are constructed of materials from so many climes, and in a manner to fit such a diversity of use. With the aggregation of